

## **CURRENT STATUS OF CLAIMS**

Please find the current status of the claims, as of the filing of this amendment paper, as follows:

1. (Previously presented) A connection for assembly of pipe, the connection comprising:
  - a first pipe having a female end;
  - a second pipe having a male end;
  - said female end having an inner surface, an internal annular shoulder, a nose face and an outer surface;
  - said male end having an inner surface, an external annular shoulder, a nose face and an outer surface;
  - a first plurality of protuberances circumferentially and longitudinally spaced relative to each other about the inner surface of said female end;
  - a second plurality of protuberances circumferentially and longitudinally spaced relative to each other about the outer surface of said male end;
  - wherein said circumferential spacing forms a circumferential array comprising at least one longitudinal column on both the inner surface of said female end and the outer surface of said male end;
  - said internal annular shoulder and said external annular shoulder being each shaped so as for each said internal shoulder and each said external shoulder to receive a mating nose face, wherein at least one said internal shoulder and/or external shoulder and its corresponding mating nose face are shaped to substantially entrap said nose face within the shoulder to substantially restrain radial movement;
  - said plurality of circumferential arrays aligned such that said plurality of protuberances are accepted by a mating pipe end when said male and female pipe ends move longitudinally relative to each other for forming a connection,
  - wherein the male and female ends engage upon any rotation of one pipe relative to the other pipe wherein such rotation causes said protuberances of the male end and said protuberances of the female end to move circumferentially with respect to each other, and wherein the nose face of the male end engages the internal annular shoulder of the female end

and the nose face of the female end engages the external annular shoulder of the male end such that compressive loads on the male end and the female end are borne substantially by the shoulders; and

at least one and/or both of said first and second protuberances embodies at least one interference dimension that causes the protuberance to displace a mating protuberance surface.

2. (Original) The connection according to claim 1 wherein said plurality of arrays comprises an odd number of said arrays.

3. (Original) The connection according to claim 2 wherein an odd number of arrays provides a positive determination of a circumferential starting point for engaging the respective protuberances of the male and female ends.

4. (Previously presented) The connection according to claim 1 wherein said connection is used for connecting pipe, which is being driven into the earth.

5. (Original) The connection according to claim 1 wherein said female end and said male end are produced at the end of separate rings, and wherein said separate rings are attached to said first pipe and said second pipe.

6. (Original) The connection according to claim 5 wherein said separate rings are attached by welding.

7. (Original) The connection according to claim 1 wherein at least some of said protuberances are shaped to be radially captured to prevent radial expansion of the female end relative to the male end.

8-9. Canceled.

10. (Original) The connection according to claim 1 wherein the protuberances are produced by at least one screw thread on said male end and a mating thread arrangement in said female end

wherein all said threads are interrupted by slots.

11. Canceled.

12. (Original) The connection according to claim 1 wherein the arrays of protuberances have at least some lead angle wherein mating of the protuberances, of the respective female and male ends, causes further longitudinal movement and resists free rotation in a direction opposite of the rotation direction for engagement.

13. (Original) The connection according to claim 1 wherein the arrays of protuberances have no lead angle.

14. (Original) The connection according to claim 1 wherein the protuberances are axially pre-loaded as a result of dimensional relationships and the rotation of one pipe relative to the other pipe.

15. (Original) The connection according to claim 1 wherein at least one protuberance in said arrays of protuberances is engagable by another protuberance to limit said rotation of one pipe relative to the other pipe.

16. Canceled.

17. (Previously presented) The connection according to claim 1 wherein the protuberances are substantially wedged shaped.

18. (Original) The connection according to claim 1 wherein said circumferential arrays form an interrupted taper thread.

19. (Original) The connection according to claim 1 wherein said circumferential arrays form an interrupted straight thread.

20. (Original) The connection according to claim 1 wherein at least one conical surface on said first pipe end is engaged and force loaded by a mating surface on said second pipe end when the connection is made up.

21. (Original) The connection according to claim 20 wherein said at least one conical surface is shaped to accept at least one seal when the connection is made up.

22. Canceled.

23. (Previously presented) A connection for assembly of pipe, the connection comprising:  
a first pipe having a female end;  
a second pipe having a male end;  
said female end having an inner surface and an outer surface;  
said male end having an inner surface and an outer surface;  
a first plurality of protuberances circumferentially and longitudinally spaced relative to each other about the inner surface of said female end;  
a second plurality of protuberances circumferentially and longitudinally spaced relative to each other about the outer surface of said male end;  
wherein said circumferential spacing forms a circumferential array comprising at least one longitudinal column on both the inner surface of said female end and the outer surface of said male end;  
said plurality of circumferential arrays aligned such that said plurality of protuberances are accepted by a mating pipe end when said male and female pipe ends move longitudinally relative to each other for forming a connection; and  
wherein the male and female ends engage upon any rotation of one pipe relative to the other pipe wherein such rotation causes said protuberances of the male end and said protuberances of the female end to move circumferentially with respect to each other; and  
a first abutting surface on said first pipe end arranged to oppose and mate with a second abutting surface on said second pipe end and a first abutting surface on said second pipe end arranged to oppose and mate with a second abutting surface on said first pipe end when the arrays of protuberances on the male end are substantially juxtaposed with the arrays of protuberances

on the female end, wherein said first abutting surfaces and said second abutting surfaces are distinct from surfaces of said protuberances, and wherein at least one of said first abutting surfaces and its corresponding second abutting surface are shaped to substantially entrap said mating second abutting surface within its corresponding mated first abutment surface to substantially restrain radial movement, and further wherein said first abutting surfaces and said second abutting surfaces are pulled into contact, with each other by engagement of the male and female protuberances upon said rotation of one pipe relative to the other pipe.

24-25. Canceled.

26. (Original) The connection according to claim 23 wherein a piping surface extends in at least one axial direction between the axially grouped protuberances and said at least one said first abutting surface.

27. Canceled.

28. (Previously presented) The connection according to claim 23 wherein each of said two abutting surfaces are some axial distance from the protuberances, further wherein said protuberances are between said abutting surfaces.

29. (Original) The connection according to claim 23 wherein said at least one second abutting surface is shaped to urge said at least one first abutting surface toward a nearest radial confining surface when said abutting surfaces experience an axially directed loading force.

30-31. Canceled.

32. (Original) The connection according to claim 23 wherein said plurality of arrays comprises an odd number of said arrays.

33. (Original) The connection according to claim 32 wherein an odd number of arrays provides a positive determination of a circumferential starting point for engaging the respective

protuberances of the male and female ends.

34. (Previously presented) The connection according to claim 23 wherein said connection is used for connecting pipe, which is being driven into the earth.

35. (Original) The connection according to claim 23 wherein the arrays of protuberances have at least some lead angle wherein mating of the protuberances, of the respective female and male ends, causes further longitudinal movement and resists free rotation in an direction opposite of the rotation direction for engagement.

36. (Original) The connection according to claim 23 wherein the arrays of protuberances have no lead angle.

37. (Previously presented) A method of making a connection comprising:

providing a first pipe having at least one female end, said female end having an inner surface, an internal annular shoulder, a nose face, and an outer surface;

providing a second pipe having a at least one male end, said male end having an inner surface said male end having an inner surface, an external annular shoulder, a nose face and an outer surface;

providing a first plurality of protuberances circumferentially and longitudinally spaced relative to each other about the inner surface of said female end;

providing a second plurality of protuberances circumferentially and longitudinally spaced relative to each other about the outer surface of said male end;

wherein said circumferential spacing forms a circumferential array comprising at least one longitudinal column on both the inner surface of said female end and the outer surface of said male end, and wherein said internal annular shoulder and said external annular shoulder being each shaped so as for each said internal shoulder and each said external shoulder to receive a mating nose face, wherein at least one said internal shoulder and/or external shoulder and its corresponding mating nose face are shaped to substantially entrap said nose face within the shoulder to substantially restrain radial movement;

aligning said first pipe and said second pipe such that the female end of said first pipe is

aligned to receive the male end of said second pipe;

further aligning said first pipe and said second pipe wherein said plurality of circumferential arrays are aligned such that said first plurality of protuberances, are accepted by a mating pipe end when the pipe ends move longitudinally relative to each other for forming a connection;

providing longitudinal movement wherein said male end will enter and mate with said female end;

continuing longitudinal movement until said male end is fully engaged in said female end;

rotating one pipe with respect to the other pipe wherein said rotation causes the protuberances of the male and female ends to move circumferentially with respect to each other and wherein the male and female ends engage each other; and

pulling the corresponding internal shoulder and its mating nose face and the external shoulder and its mating nose face into contact, with each other by engagement of the male and female protuberances upon said rotation of one pipe relative to the other pipe, wherein said internal shoulder and its corresponding mating nose face and said external shoulder and its corresponding mating nose face are distinct from surfaces of said protuberances, and wherein the contact of the shoulders and the mating nose faces causes compressive loads on the male end and the female end to be borne substantially by the shoulders.

38. (Original) The method of Claim 37, wherein the rotation of one pipe segment with respect to the other pipe segment is less than 20 degrees.

39. (Previously presented) The method of Claim 37, wherein said connection is used for connecting pipe, which is being driven into the earth.

40-50. Canceled.

51. (Previously presented) A threaded connection for end-to-end assembly of pipe sections to pipe strings, the connection comprising:

a first pipe end with a socket and a second pipe end with a pin to mate with said socket;  
a plurality of first cam patches of first arcuate cams extending peripherally about the inner

surface of said socket, said first cam patches separated by surfaces defining peripherally extending first slots;

a plurality of second cam patches of second arcuate cams extending peripherally about the outer surface of said pin, said second cam patches separated by surfaces defining peripherally extending second slots;

all said slots and patches arranged such that said patches are accepted by said slots when said pin end is axially inserted into said socket;

all said arcuate cams axially distributed some distance and comprising lands and grooves peripherally extending some distance in a selected helical direction, said grooves configured to accept said lands when rotation of said box relative to said pin causes said lands to move peripherally along said grooves; and

a first abutting surface on said first pipe arranged to oppose and mate with a second abutting surface on said second pipe and a first abutting surface on said second pipe arranged to oppose and mate with a second abutting surface on said first pipe, with a selected axial force, when said patches on said pin are approximately juxtaposed with said patches on said socket,

wherein said abutting surfaces are pulled into contact, with each other by engagement of the pin and socket patches upon said rotation of said box relative to said pin, and wherein said abutting surfaces are distinct from surfaces of the pin and socket patches and wherein at least one of said first abutting surfaces and its corresponding second abutting surface are shaped to substantially entrap said mating second abutting surface within its corresponding mated first abutment surface to substantially restrain radial movement.

52-53. Canceled.

54. (Previously presented) The connection according to claim 51 wherein a tubular surface extends in at least one axial direction between said cam patches and the first abutting surface.

55. Canceled.

56. (Original) The connection according to claim 55 wherein each of said two abutting surfaces are some axial distance from said patches, said patches between said abutting surfaces.



57. (Original) The connection according to claim 51 wherein at least some of said lands and their related said grooves are shaped to radially capture said lands within its related said grooves to prevent radial expansion of said socket relative to said pin.

58. (Original) The connection according to claim 51 wherein said at least one second abutting surface is shaped to urge said at least one first abutting surface toward a nearest radial confining surface when said abutting surfaces experience an axially directed loading force.

59. Canceled.

60. (Original) The connection according to claim 51 wherein at least one of said arcuate cams embodies at least one interference dimension that causes one surface to displace a mating surface, by material strain, to increase the torque required to rotate said first pipe relative to said second pipe.

61. (Original) The connection according to claim 51 wherein said cams are produced by at least one screw thread on said pin and a mating thread arrangement in said socket, wherein all said threads are interrupted by said slots to produce said arcuate cams.

62. Canceled.

63. (Original) The connection according to claim 51 wherein at least one conical surface on said first pipe end is engaged and force loaded by a mating surface on said second pipe end when the connection is made up.

64. (Original) The connection according to claim 63 wherein said at least one conical surface is shaped to accept at least one ring seal when the connection is made up.

65. (Original) The connection according to claim 51 wherein at least some of said lands and grooves have dimensional relationships such that an interference resists rotation of said socket relative to said pin, said interference requiring expansion of said socket for the connection to be

completed.

66. (Original) The connection according to claim 51 wherein all arcuate cams are made from at least one thread, said thread to begin with a minimum axial dimension and expand uniformly and continually throughout the thread peripheral dimension, the grooves receiving said thread axially dimensioned to fully engage both flanks of the thread when connection make-up is complete.

67-68. Canceled.

69. (Previously presented) A threaded connection for end-to-end assembly of pipe sections, the connection comprising:

first and second pipe ends to be threadedly joined, said first pipe having female configuration defined as a box, the second pipe having mating male configurations defined as a pin;

the box having, in series, a first abutment surface defining one end of the first pipe, a first unthreaded length, a first threaded length, a second unthreaded length, and a second abutment surface to terminate the box configuration on the first pipe;

the pin having, in series, a third abutment surface to mate said second abutment surface, a third unthreaded length to be received in the second unthreaded length, a second threaded length to mate with the first threaded length, a fourth unthreaded length to be received in the first unthreaded length, and a fourth abutment surface to mate with the first abutment surface and terminate the pin configuration, wherein at least one of the mating third and second abutment surfaces and/or the mating fourth and first abutment surfaces are shaped so as to substantially entrap the second or fourth abutment within its correspondingly mating first or third abutment;

the first and second threaded lengths, each, comprising at least two patches of incomplete threads on the pin and similar and mating patches of incomplete threads in the box, all said patches formed by peripheral thread cut-outs producing surfaces to define slots which will accept the patches when the box receives the pin in axial relative movement, the patches on the pin arranged to engage the patches in the box when the pin is rotated relative to the box, at least one of said incomplete thread embodies at least one interference dimension that causes the

incomplete thread to displace a mating incomplete thread surface when the patches on the pin engage the patches on the box, said abutting surfaces to be axially force loaded, when said at least one mating incomplete thread surface is displaced, a preselected amount when the patches on the pin are approximately juxtaposed with the patches on the box, wherein the abutment surfaces are distinct from surfaces of said patches of incomplete threads.

70-71. Canceled.

72. (Original) The threaded connection of claim 69 further comprising a first and second conical surface, wherein the first and the second conical surfaces open toward the end of the pin.

73. (Original) The threaded connection of claim 69 wherein said thread and its receiving groove are tapered such that, when the patches are juxtaposed, each uninterrupted length of thread fully fills at least the axial dimension of the receiving thread groove.